DOCUMENT RESUME

ED 456 822 IR 020 878

TITLE	Education Technology Must Be Included in Comprehensive Education Legislation. A Policy Paper.
INSTITUTION	CEO Forum on Education and Technology, Washington, DC.
PUB DATE	2001-03-00
NOTE	14p.
AVAILABLE FROM	CEO Forum on Education and Technology, 1341 G Street, N.W., Suite 1100, Washington, DC 20005. Tel: 202-393-2260; Fax: 202-393-0712; Web site: http://www.ceoforum.org. For full text: http://www.ceoforum.org/reports.cfm?RID=5.
PUB TYPE	Opinion Papers (120)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Curriculum Development; Educational Change; *Educational Development; *Educational Finance; Educational Policy; *Educational Technology; Elementary Secondary Education; *Federal Aid; Federal Government; *Partnerships in Education; *Policy Formation; Technology Integration

ABSTRACT

Founded in 1996, the CEO Forum on Education & Technology is a unique five-year partnership between business and education leaders committed to assessing and monitoring progress toward integrating technology in America's schools. In this document, the CEO Forum makes a series of strategic recommendations on the most effective role of technology in education policy reform. The CEO Forum offers three major recommendations to federal policymakers, based on three critical areas of education technology that are discussed in detail. The first recommendation is: broaden student achievement to include 21st century skills. Development of 21st century skills is critical to students' success in the digital age. These skills need to be included in the standards, curriculum and assessment. The Department of Education should establish accountability models for inclusion of 21st century skills as an additional discipline. These models should establish approaches that can be followed to create metrics of success for assessment and accountability of these skills. The second recommendation is: expand federal support for education technology investments. The federal government should double the national investment in education technology, and continue to emphasize equity in funding by ensuring that the schools with the greatest need benefit most from federal educational technology programs. By 2003, the federal government should apply at least 30% of federal education technology funding to provide sustained and intensive high-quality professional development for the integration of education technology into the curriculum. The government should provide leadership in the creation of digital content that will help boost student achievement. The third recommendation is: increase investment in research and development and dissemination. The federal government should increase its investment in dedicated education technology research and development to at least $100 million. Research and development should be used to determine the most effective technology methods to improve student achievement, and support the development of assessment tools that measure 21st century skills. The federal government should fund President Bush's $15 million proposal for a Web-based Clearinghouse of Best Practices in Education Technology. The creation of an education technology clearinghouse is an effective way for educators to gain a better sense of the

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The CEO Forum
on Education & Technology

Education Technology Must Be Included in Comprehensive Education Legislation

A Policy Paper by the
CEO Forum on Education and Technology

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March 2001

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CEO Forum on Education & Technology

Founded in 1996, the CEO Forum on Education & Technology is a unique five-year partnership between business and education leaders who are committed to assessing and monitoring progress toward integrating technology in America's schools. The CEO Forum hopes to ensure that the nation's students will achieve higher academic standards and will be equipped with the skills they need to be contributing citizens and productive workers in the 21st century.

Organizing Principles

- All students must graduate with the technology skills needed in today's world and tomorrow's workplace.
- All educators must be equipped to use technology as a tool to achieve high academic standards.
- All parents and community members must stay informed of key education technology decisions confronting policymakers, administrators and educators.
- All students must have equitable access to technology.
- The nation must invest in education technology research and development.

The CEO Forum Four Year Agenda

YEAR 1

The School Technology and Readiness Report: From Pillars to Progress (October 1997)

The first report issued by the CEO Forum focused on the importance of integrating all the elements of education technology, from hardware and connectivity to professional development and content.

- STaR Chart, a self-assessment tool for schools to gauge progress toward integrating technology to improve education.
- STaR Assessment, a benchmark measure of national progress toward integrating technology in schools.

YEAR 2

Professional Development: A Link to Better Learning (February 1999)

This second-year report focused on educator professional development, the foundation for effective use of technology in education.

- Ten Principles for Effective Professional Development
- STaR Chart Update
- STaR Assessment Update

YEAR 3

The Teacher Preparation STaR Chart: A Self-Assessment Tool for Colleges of Education (January 2000)

This self-assessment tool enabled colleges of education to determine their institution's level of readiness in preparing tomorrow's teachers to integrate educational technology into instruction.

The Power of Digital Learning: Integrating Digital Content (June 2000)

This report offered a vision for digital learning and focuses on the actions that schools, teachers, students and parents must take to integrate digital content into the curriculum to create the learning environments that develop 21st century skills.

- Creating a Digital Content Strategy
- STaR Chart Update

YEAR 4

21st Century Accountability (June 2001)

The final CEO Forum report focuses on the positive educational objectives that can be achieved through the effective use of educational technology, and on the corresponding changes that must occur in assessment in order to develop and measure 21st century skills.

- STaR Chart Update

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I. Introduction

Information technology is transforming the global economy and drastically changing the way business and society operates. There must be a corresponding adaptation in education to ensure students have the necessary skills to thrive in the digital age. Understanding how to employ technology to locate and evaluate information, to learn, reason, make decisions, solve problems, and to collaborate and work in teams will be essential abilities in the rapidly changing world. These are the 21st century skills[1] that will be crucial for students to thrive in the digital age. Without a serious and significant investment in these skills, curricula and accountability, our schools face the almost impossible challenge of trying to create 21st century learners for a 21st century workforce in 20th century educational environments. This is a critical national issue that must be addressed in the proposed federal legislation.

The current House, Senate and Administration proposals, including President Bush's proposal "*No Child Left Behind*," are important contributions to the future of education policy. We are, however, concerned that these major bills lack significant educational technology proposals.

Critical need for 21st century skills

The emergence of new information technologies, the evolution of the global digital economy, and the global competition for technically skilled workers creates a national urgency to improve our educational system. Schools that functionally reflect the culture of the past, rather than the demands of the future, will not prepare students to thrive in the digital age. This is an issue of preeminent national importance. We cannot rest complacently on our position as a world leader. Unless we continue to ensure that our educational system improves achievement for all students, the future of our nation and our children is threatened. In addition, in order to assure our students are ready to thrive in the future, we must broaden our definition of student achievement to include 21st century skills.

Contribution of the CEO Forum

The CEO Forum on Education and Technology entered the national conversation on these issues in 1996. In our first report we urged schools to acquire hardware and connectivity.[2] Recognizing that skilled teachers who understand how to integrate technology into the

[1] North Central Region Education Laboratory's (NCREL) list of 21st century skills builds on and synthesizes the work of the United States Secretary of Labor's Commission on Achieving Necessary Skills (SCANS), The International Society for Technology in Education (ISTE), Emotional Intelligence, American Association of School Administrators (ASSA), the American Library Association (ALA), National Academy of Sciences, United States Office of Personnel Management and the National Study of School Evaluation (NSSE). These skills include digital age and technological literacy, inventive thinking, effective communication and the ability to create high quality products.

[2] The School Technology and Readiness Report: From Pillars to Progress (October, 1997).

curriculum to achieve educational objectives are pivotal to the digital and web based learning that improve student achievement, our second report focused on professional development.[3] Then, we issued a clarion call to colleges of education to train the next generation of teachers with the requisite technology skills.[4] Our publication on digital learning and digital content offered recommendations on integrating the high quality digital content that creates the dynamic curriculum that challenges students to meet higher standards and develop 21st century skills.[5] Our final report on 21st Century Accountability will be published in June, 2001. Throughout, our exploration has been guided by extensive research, debate, lessons drawn from the business community and interactions with educators and policymakers.

The power and potential of education technology

Over the past four years, schools, states and the federal government have made great strides in acquiring the critical technology infrastructure and training to support integrating technology into schools and school curriculum. We are deeply impressed with the efforts that have been made to make education technology a priority. Initially our national focus had to be centered on preparing schools to harness technology. Now, we need to apply technology's powerful tools to change the way our students learn. As policy and decision makers expand their education technology decisions, The CEO Forum wants to help assure that clear goals and priorities are established to protect and to further the value of education technology investments.

The CEO Forum strongly supports the national emphasis on accountability. However, for accountability to be effective, standards, curriculum, assessment, research and development and continuous improvement must all be aligned to improve student achievement and develop 21st century skills. Too often, the assessment linked to accountability measures updated standards with outdated tests. Education technology can help reinvent assessment and further the continuous improvement strategies that will make accountability successful.

In order to meet the demands of the global economy, we must look at all aspects of the federal educational technology investment, including student achievement, professional development, federal funding, infrastructure, and research and development. In order to elevate student achievement and prepare students for the challenges of the future, federal leadership must support teachers, develop 21st century skills, and promote research and development that will explore how to assess and achieve these goals. Education technology is not the solution in and of itself. But when integrated into the curriculum to achieve specific educational objectives, technology can produce dramatic results. The CEO Forum hopes to help policymakers understand the pivotal role technology can play in meeting federal, state, and local educational objectives. We have examined the various reform proposals and are herein making a series of strategic recommendations on the most effective role of technology in education policy reform.

21st Century Skills

Digital Age Literacy

1. Basic, Scientific, and Technological Literacy
2. Visual and Information Literacy
3. Cultural Literacy and Global Awareness

Inventive Thinking

4. Adaptability/Managing Complexity
5. Curiosity, Creativity, and Risk Taking
6. Higher Order Thinking and Sound Reasoning

Effective Communication

7. Teaming, Collaboration, and Interpersonal Skills
8. Personal and Social Responsibility
9. Interactive Communication

High Productivity

10. Prioritizing, Planning, and Managing for Results
11. Effective Use of Real-World Tools
12. Relevant, High Quality Products

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[3] Professional Development: A Link to Better Learning (February, 1999).
[4] Teacher Preparation STaR Chart: A Self-Assessment Tool for Colleges of Education (January, 2000).
[5] The Power of Digital Learning: Integrating Digital Content (June, 2000).

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II. Recommendations

The CEO Forum offers three major recommendations to federal policymakers:

Broaden student achievement to include 21st century skills

1. The development of 21st century skills is critical to students' success in the digital age. Therefore, 21st century skills need to be included in the standards, curriculum and assessment. The Department of Education should establish accountability models for the inclusion of 21st century skills as an additional discipline. These models should establish approaches that can be followed to create metrics of success for assessment and accountability of 21st century skills.

Expand federal support for education technology investments

2. The federal government should double the national investment in education technology.
   - The federal government should continue to emphasize equity in funding by ensuring that the schools with the greatest need benefit most from federal educational technology programs.
   - By 2003, the federal government should apply at least 30 percent of federal education technology funding to provide sustained and intensive high-quality professional development for the integration of education technology into the curriculum.
   - The federal government should provide leadership in the creation of digital content that will help boost student achievement.

Increase investment in research and development and dissemination

3. The federal government should increase its investment in dedicated education technology research and development to at least $100 million. This is similar to the education technology proposal made by President Bush during the fall campaign. Research and development should be used to determine the most effective technology methods to improve student achievement, and support the development of assessment tools that measure 21st century skills.
   - The federal government should fund President Bush's $15 million proposal for a web-based Clearinghouse of Best Practices in Education Technology. The creation of an education technology clearinghouse is an effective way for educators to gain a better sense of the quality of the work achieved by their peers. This clearinghouse will also support more effective professional development.

These three recommendations are based on three critical areas of education technology that the CEO Forum believes should be a central focus of the current education debate.

III. Three Critical Areas of Education Technology

1. Broaden definition of student achievement and methods of assessment to include 21st century skills

The CEO Forum believes that our conventional definitions of student achievement and assessment are much too narrow to meet the demands of the global economy. In order to succeed as productive citizens in the 21st century, students should graduate from high school with a vast and diverse set of skills and knowledge, including, but scarcely limited to: reading, mathematical and scientific understanding and application, and social studies. The CEO Forum believes it is now time to build on these traditional 20th century subject areas, and therefore, we urge federal policy makers integrate 21st century skills into the definition of student achievement. These 21st century skills must include the technology and digital age literacy, inventive thinking, effective communication, and high productivity skills that will be essential for citizens in the rapidly changing digital age.

How should we define student achievement?

The CEO Forum asks federal and state policy makers to expand their definition of student achievement to include 21st century skills. While policymakers have continued to emphasize traditional subjects such as reading and math, it is also important to focus on the role that information and communications technologies can play in preparing students for life and work in the 21st century. As we integrate technology into core subjects, then state and local education decision makers must also focus on developing 21st century skills in students.

21st century skills are new standards for literate students in the information age. Digital and technology literacy, like basic reading literacy, is a fundamental skill that will enable advanced learning. Federal and state governments should demand basic technology literacy for all students. But technology literacy is not enough. We must also ensure that our children have the ability to move beyond basic skills to apply higher order problem-solving skills that will be needed to compete in the new and ever changing information economy. Students must be able to use technology's tools to enhance learning; increase productivity; promote creativity; research topics online; proficiently use web-based tools; evaluate sources; develop problem solving strategies; and incorporate technology into their coursework.

What role should technology play in assessment?

All of the major education bills call for an increase in student assessment. The CEO Forum supports the increase in assessment, but believes that technology can be an important tool for providing better, more comprehensive and more readily accessible assessment. Educators often caution that state-mandated standardized tests occur too late in the school year to allow for the modifications to teaching and learning that improve student achievement. Technology can help assessment become an essential part of the teaching and learning process, shifting assessment from a one-time snapshot to a diagnostic tool that provides essential feedback on performance. Additionally, assessments should also measure all skills in state standards and educational objectives, and preferably employ the tools that were integrated into the curriculum. Therefore, as educators integrate technology into all subject areas of the curriculum, we need to incorporate new forms of assessment to reflect this shift.

Too often, today's tests measure yesterday's skills using yesterday's technology. The same innovative technologies that are changing the way teachers teach and students learn, can be employed to reinvent the way we assess student achievement. Testing technologies make it possible to change test formats to assess specific abilities and cognitive skills more effectively. In addition, because technology can compile and report student performance immediately, assessment can become an integral part of the teaching and learning process. Technology has the ability to expand traditional test models, and is a natural solution for increased accountability measures. Technology also provides the means to analyze testing data and focus and modify instructional strategies to improve student achievement.

Current state accountability models focus on standardized testing to measure the extent to which students have mastered standards established by the state. However, few states have adopted standards for 21st century skills, and widespread metrics are still not available for measuring those performance and higher order skills. The federal government should create sample models of accountability that include 21st century skills as a component of an overall accountability model and explore technology's ability to provide more consistent, comprehensive and effective assessment.

What does the CEO Forum recommend?

Broaden student achievement to include 21st century skills.

1. The development of 21st century skills is critical to student's success in the digital age. Therefore, 21st century skills need to be included in the standards, curriculum and assessment. The Department of Education should establish accountability models for inclusion of 21st century skills as an additional discipline. These models should create approaches that can be followed to create metrics of success for assessment and accountability of 21st century skills.

2. Protect and expand long-term federal support for education technology investments

Successful integration of technology into the learning process can only be achieved with the appropriate resources. Federal programs must reflect and support the new and evolving issues in effective technology deployment that improves student achievement.

What should be the federal long-term educational technology investment strategy?

At the federal level, the CEO Forum believes we need a long-term educational technology investment strategy focused on learning. Technology has the power to bring a vast resource of knowledge to every child in the country. The federal government can play a critical role in ensuring that ***all*** students can benefit from the technology-based learning, such as web-based education, that develops 21st century skills.

The CEO Forum has three clear principles on how federal funding should be applied:

- *Continue investing in technologies that develop 21st Century Skills.* In recent years, federal investments in educational technologies have grown substantially, reflecting the growing importance of technology in the learning environment. The CEO Forum believes that there must be a continued focus and sustained investment in technology if we are to achieve the full promise of educational technology. In order for local decision makers to refocus their technology investments on learning, we must ensure that federal investment levels are sufficient and flexible enough to support greater investments in professional development

and digital content development without sacrificing investments in other areas. One important study suggests that we as a nation must invest a significant amount of the overall K-12 budgets on educational technology if schools are to have the resources necessary to truly integrate technology into learning.[6] However today, quite a small percentage of K-12 spending is invested in educational technology.[7] The integration of education technology is not a quick process. Federal policy makers need to ensure long-term funding strategies for education technology so that schools can develop long-term technology plans that support full-scale technology use.

- *A call for equity in funding.* One of the greatest promises of educational technology is the potential for widespread, equal access to ideas, information and learning. We must commit ourselves to making sure that the full range of technology is broadly available to ensure that every student has access to a 21st Century learning environment. Unfortunately today, while most children have access to the Internet in their classroom, 6 out of 10 poor students lack access.[8] Likewise, 16 poor students share one modern computer compared to 7 well-off students sharing one computer.[9] Teachers are also affected. Teachers in poor schools are less likely to have the skills necessary to incorporate technology into learning and teaching. Furthermore, unequal access to technology at home only exacerbates the problem. The CEO Forum believes that as our nation moves forward in integrating technology into learning, it is imperative that technology be used to remove existing educational barriers rather than to create new ones.

- *An investment strategy focused on integration into teaching and learning.* Education technologies should be integrated into all aspects of learning - from bilingual education, to after-school programs, to professional development. Education technology funding needs to emphasize integration by focusing on pre-service teachers, professional development, content and assessment. Education technology should not be focused on just connecting computers to the Internet, but rather on connecting children to new learning opportunities. Funding for education technology needs to reflect all elements of the integration process. The CEO Forum recommends that federal policymakers look at every major education program to explore the appropriate role that technology can play.

Federal policymakers should focus on developing a teacher technology competency strategy

Ultimately, the CEO Forum believes that teachers will use technology as effectively and seamlessly as they employ chalkboards today. But, in order for technology to be integrated into teaching, teachers need to have a strong understanding of the role of technology and how it can be integrated throughout the curriculum. Furthermore, teacher technology competency should be a part of the teacher quality measurement.

In order to promote teacher technology competency, the federal government, states and districts must give greater focus to the role of professional development. Strong pre-service and in-service professional development is the key to expanding the knowledge and expertise

[6] See President's Committee of Advisors on Science and Technology, Panel on Educational Technology, "Report to the President on the Use of Technology to Strengthen K-12 Education in the United States," March 1997.

[7] The U.S. spends $389 billion on K-12 education according to the National Center for Educational Statistics, Digest of Education Statistics 2000. At the same time, Quality Education Data's Technology Purchasing Forecast, 1999-2000, 5th edition, estimates $6.7 billion is spent on education technology.

[8] U.S. Department of Education, National Center for Education Statistics, "Internet Access in U.S. Public Schools and Classrooms: 1994-1999," February 2000.

[9] Ibid.

in the use of technology in teaching and learning to maximize student achievement.[10] Studies continue to demonstrate that educators' access to professional development remains the single most critical factor in whether or not technology improves student achievement. Educators must have time, access and high quality professional development if we are to realize the full benefits of instructional technology.

In the CEO Forum's Year Two Report on Professional Development, we recommended that Schools of Education should prepare new teachers to integrate technology effectively into the curriculum. We also asked every state to develop standards for effective continuing education on integrating technology into the curriculum. We reaffirm our recommendations, and ask that university, state and local educators examine how technology professional development is provided during all stages of a teacher's career.

What does the CEO Forum recommend?

Expand federal support for education technology investments

1. The federal government should double the national investment in education technology.
   - The federal government should continue to emphasize equity in funding by ensuring that the schools with the greatest need benefit most from federal educational technology programs.
   - By 2003, the federal government should apply at least 30 percent of federal education technology funding to provide sustained and intensive high-quality professional development for the integration of education technology into the curriculum.
   - The federal government should provide leadership in the creation of digital content that will help boost student achievement.

3. Create a research and development strategy tied to student achievement and dissemination

In order for schools to use technology's powerful tools for improving student achievement, there must be a more comprehensive understanding of technology's best practices and effectiveness. The CEO Forum believes that there needs to be a major increase in research and development for education technology.

Research and development needs to be tied to areas of student achievement and support a clear case for using technology in education. There is growing evidence of a direct link between use of technology and increased student achievement. This needs to be more clearly demonstrated through research.

In 1999, our nation spent more than $300 billion on public K-12 education, but invested less than 0.1 percent of that amount to determine what educational techniques actually work, or to investigate ways to improve them.[11] By comparison, Kellogg, the maker of the breakfast cereals many children eat before school, spends two percent of its resources on research and development to improve its product.[12] Clearly educational research remains under funded.

[10] Professional Development: A Link to Better Learning (February, 1999). Teacher Preparation STaR Chart: A Self-Assessment Tool for Colleges of Education (January, 2000).
[11] Web-based Education Commission. "The Power of the Internet for Learning," December 2000, Testimony of David Shaw to the Commission.
[12] Merrill Lynch Book of Knowledge: investing in the Growing Education and Training industry pg. 66. President's Committee on Science and Technology.

The CEO Forum supports an increase in directed and undirected research for education technology. The research should parallel the move to broaden the definition of student achievement to include 21st century skills. A major goal of the research should be to determine how students learn and how technology can best be deployed to support learning and achievement. In addition, research mechanisms should examine both current and future technology tools. Given the dizzying pace of technological change, the CEO Forum calls for short-term, powerful research efforts to foster immediate understanding of the most effective learning technologies. Other research can form the foundation for the next generation of educational technology learning products.

Already, research[13] shows that, when implemented correctly, technology can be a powerful tool for increasing student achievement. It can boost student scores, improve attendance, enhance professional development for teachers, assist special education students, and increase parental involvement in education. There are also numerous intangible changes that happen when technology is integrated into schools. Anecdotal evidence shows that technology encourages student engagement and motivation, key elements to increased student achievement.[14]

In order for schools, and even more importantly, teachers to employ research to guide and improve teaching and learning, they must have access to useful and timely research-based information that can help them make appropriate decisions about how best to use technology with their students. The research needs to reach the K-12 community in a timely fashion, whether through publication of studies in mainstream education publications, through the Internet, or through presentation and visibility at major education conferences. Unless a satisfactory and effective dissemination plan is in place, research will not reach those who can leverage it for the greatest impact in our nation's schools. In addition, research should be coordinated and peer reviewed to avoid redundancy and research gaps.

What does the CEO Forum recommend?

Increase investment in research and development and dissemination

1. The federal government should increase its investment in dedicated education technology research and development to at least $100 million. This is similar to the education technology proposal made by President Bush during the fall campaign. Research and development should be used to determine the most effective technology methods to improve student achievement, and support the development of assessment tools that measure 21st century skills.
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[13] Sivin-Kachala, J. (1998). Report on the effectiveness of technology in schools, 1990-1997. Software Publisher's Association. Wenglinsky, H. (1998) Does it Compute? The Relationship Between Education Technology and Student Achievement in Mathematics.

[14] Kulik, J. (1994). "Meta-Analytic Studies of Findings on Computer-Based Instruction in "Technology Assessment in Education and Training" by E.L. Baker and H.F. O'Neil, Jr. (eds). Hillsdale, NJ: Lawrence Erlbaum.

IV. Summary

The CEO Forum offers these three recommendations to federal policymakers:

Broaden student achievement to include 21st century skills

1. The development of 21st century skills is critical to students' success in the digital age. Therefore, 21st century skills need to be included in the standards, curriculum and assessment. The Department of Education should establish accountability models for inclusion of 21st century skills as an additional discipline. These models should establish approaches that can be followed to create metrics of success for assessment and accountability of 21st century skills.

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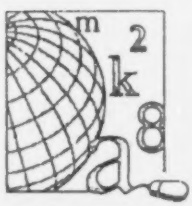

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